TSF60R280S1

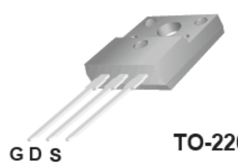
600V 15A N-Channel SJ-MOSFET

General Description

Truesemi SJ-FET is new generation of high voltage MOSFET family that is utilizing an advanced charge balance mechanism for outstanding low on-resistance and lower gate charge performance.
This advanced technology has been tailored to minimize conduction loss, provide superior switching performance, and withstand extreme dv/dt rate and higher avalanche energy.
SJ-FET is suitable for various AC/DC power conversion in switching mode operation for higher efficiency.

Features

- 650V @TJ = 150 ℃
- Typ. RDS(on) = 0.24Ω
- Ultra Low gate charge (typ. Qg = 43nC)
- 100% avalanche tested



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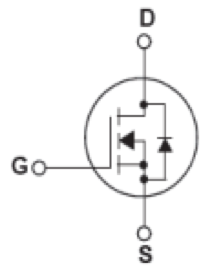


Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V_{DSS}	Drain-Source Voltage	600	V
I_D	Drain Current -Continuous (TC = 25℃) -Continuous (TC = 100℃)	15* 9.4*	A
I_{DM}	Drain Current – Pulsed (Note 1)	45*	A
V_{GSS}	Gate-Source voltage	±30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	284	mJ
I_{AR}	Avalanche Current (Note 1)	2.4	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	0.43	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	15	V/ns
P_D	Power Dissipation (TC = 25℃)	32	W
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	℃
T_L	Maximum Lead Temperature for Soldering Purpose,1/8" from Case for 5 Seconds	300	℃

* Drain current limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	3.9	℃/W
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink Typ.	--	℃/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	80	℃/W

Electrical Characteristics TC = 25℃ unless otherwise noted

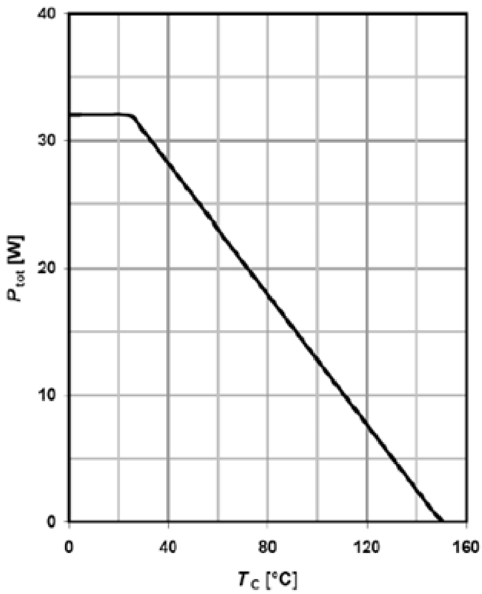
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0V, I_D = 250μA, T_J = 25℃	600	--	--	V
		V_{GS} = 0V, I_D = 250μA, T_J = 150℃	--	650	--	V
$\Delta BV_{DSS} / \Delta_{TJ}$	Breakdown Voltage Temperature Coefficient	I_D = 250μA, Referenced to 25℃	--	0.6	--	V/℃
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 600V, V_{GS} = 0V -T_J = 150℃	--	-- 10	1 --	μA μA
I_{GSSF}	Gate-Body Leakage Current, Forward	V_{GS} = 30V, V_{DS} = 0V	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	V_{GS} = -30V, V_{DS} = 0V	--	--	-100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250μA	2.5	--	4.5	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10V, I_D = 7.5A	--	0.24	0.28	Ω
g_{FS}	Forward Trans conductance	V_{DS} = 40V, I_D = 15A (Note 4)	--	16	--	S
R_g	Gate resistance	f=1 MHz, open drain	--	3.5	--	Ω
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz	--	800	--	pF
C_{oss}	Output Capacitance		--	340	--	pF
C_{rss}	Reverse Transfer Capacitance		--	10	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 400V, I_D = 7.5A R_G = 20Ω(Note 4, 5)	--	13	--	ns
t_r	Turn-On Rise Time		--	11	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	100	--	ns
t_f	Turn-Off Fall Time		--	12	--	ns
Q_g	Total Gate Charge	V_{DS} = 480V, I_D = 7.5A V_{GS} = 10V (Note 4, 5)	--	43	--	nC
Q_{gs}	Gate-Source Charge		--	5	--	nC
Q_{gd}	Gate-Drain Charge		--	22	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	15	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	45	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0V, I_F = 7.5A	--	0.9	1.5	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0V, I_F = 7.5A di_F/dt =100A/μs (Note 4)	--	345	--	ns
Q_{rr}	Reverse Recovery Charge		--	4.5	--	μC

NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I_{AS}=2.4A, V_{DD}=50V, Starting TJ=25 ℃
3. I_{SD}≤15A, di/dt ≤ 200A/us, V_{DD} ≤ BV_{DSS}, Starting TJ = 25 ℃
4. Pulse Test: Pulse width ≤ 300us, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature Typical Characteristics

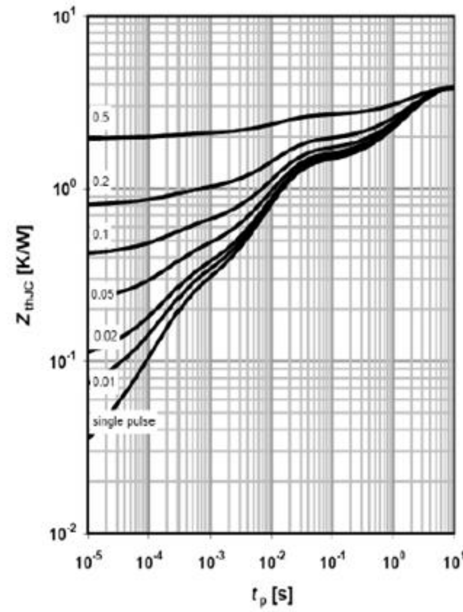
Typical Performance Characteristics

Power dissipation



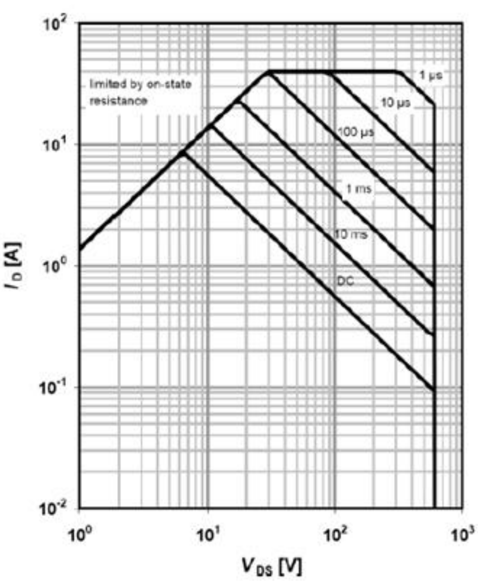
$P_{tot} = f(T_C)$

Max. transient thermal impedance



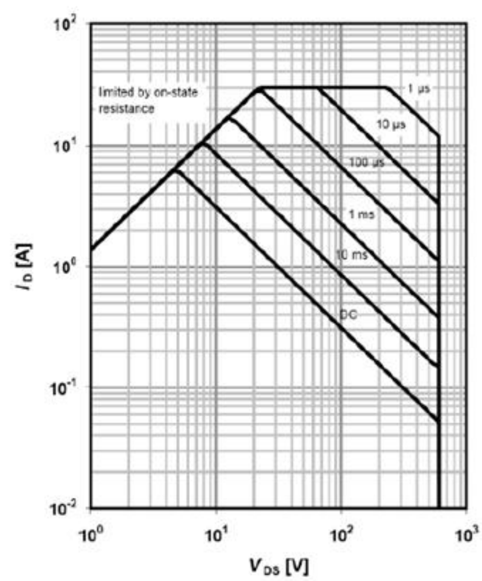
$P_{tot} = f(T_C)$

Safe operating area T_C=25 ℃



$I_D = f(V_{DS})$; T_C=25 ℃; V_{GS} > 7V; D=0; parameter t_p

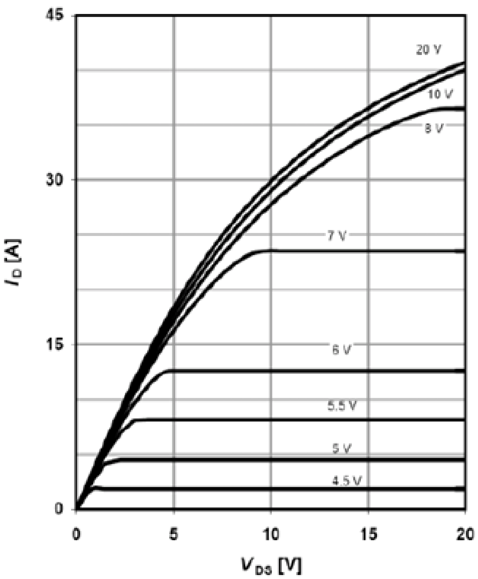
Safe operating area T_C=80 ℃



$I_D = f(V_{DS})$; T_C=80 ℃; V_{GS} > 7V; D=0; parameter t_p

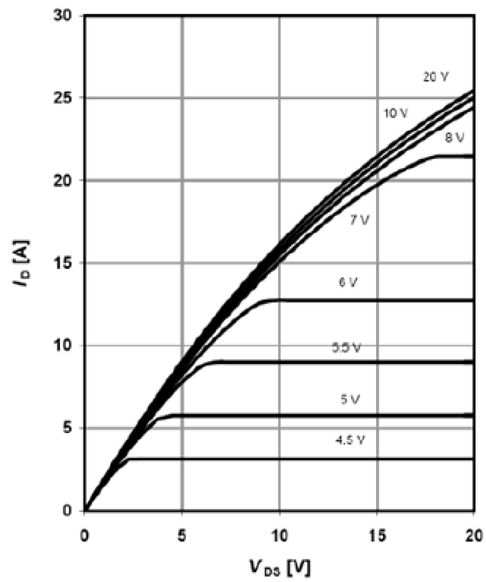
Typical Performance Characteristics

Typ. output characteristics *T_j=25 ℃*



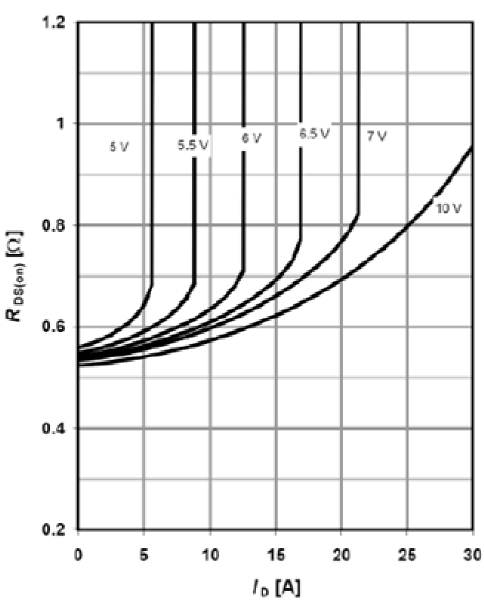
I_D=f(V_{DS}); T_j=25 ℃ ; parameter: V_{GS}

Typ. output characteristics *T_j=125 ℃*



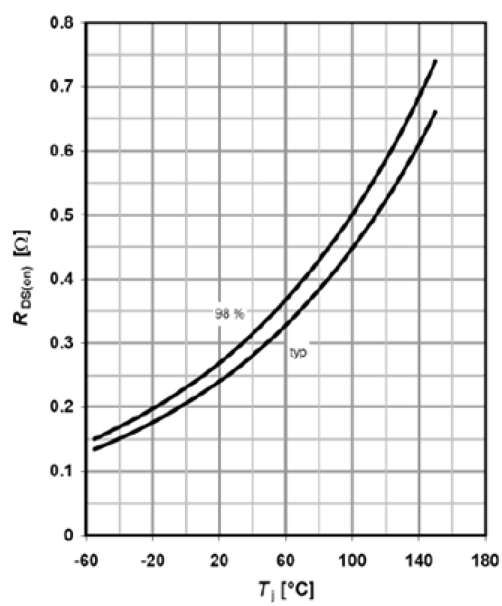
I_D=f(V_{DS}); T_j=125 ℃ ; parameter: V_{GS}

Typ. drain-source on-state resistance



R_{DS}(on)=f(I_D); T_j=125 ℃ ; parameter:V_{GS}

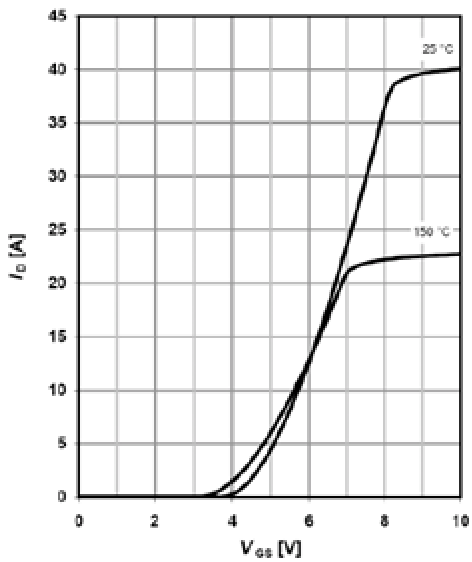
Typ. drain-source on-state resistance



R_{DS}(on)=f(T_j); I_D=6.5 A; V_{GS}=10 V

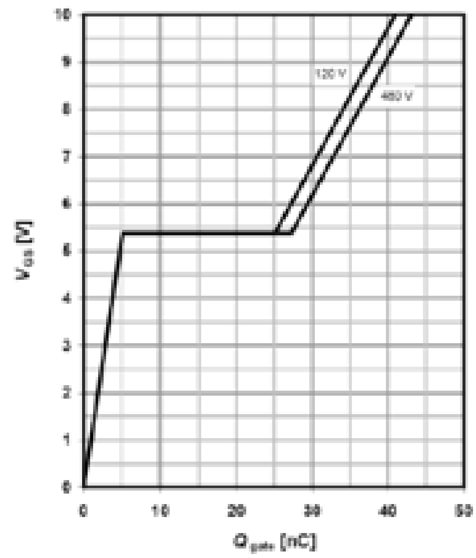
Typical Performance Characteristics

Typ. transfer characteristics



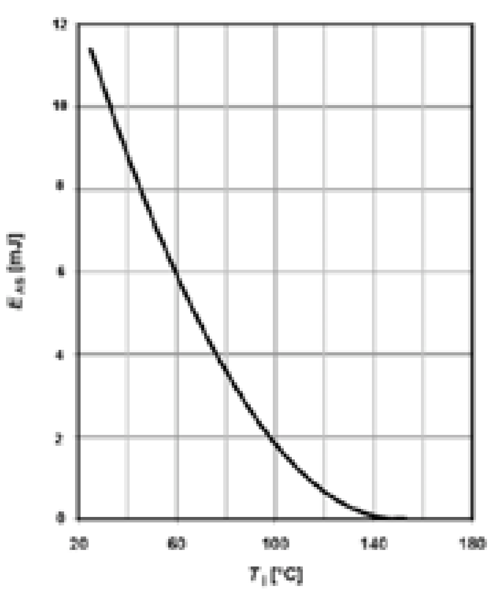
I_D=f(V_{GS}); V_{DS}=20V

Typ. gate charge



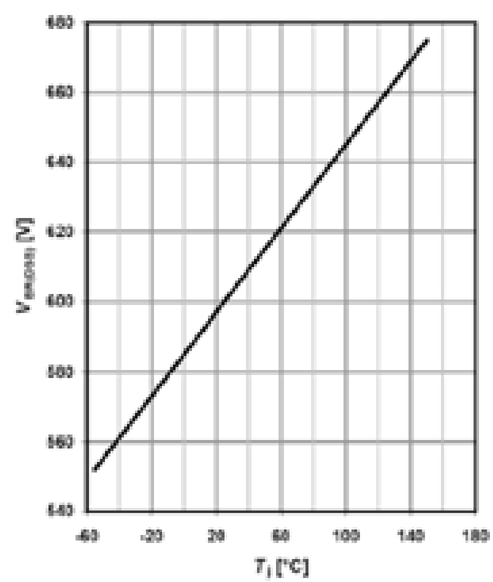
V_{GS}=f(Q_g), I_D=6.5 A pulsed

Avalanche energy



E_{AS}=f(T_j); I_D=6.5 A; V_{DD}=50 V

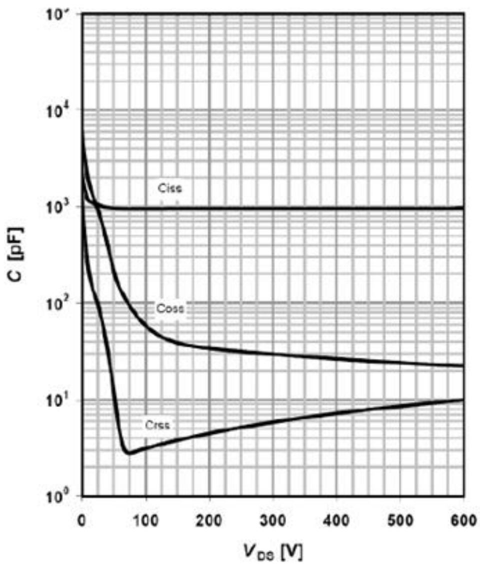
Drain-source breakdown voltage



$V_{BR(DSS)}$=f(T_j); I_D=0.25 mA

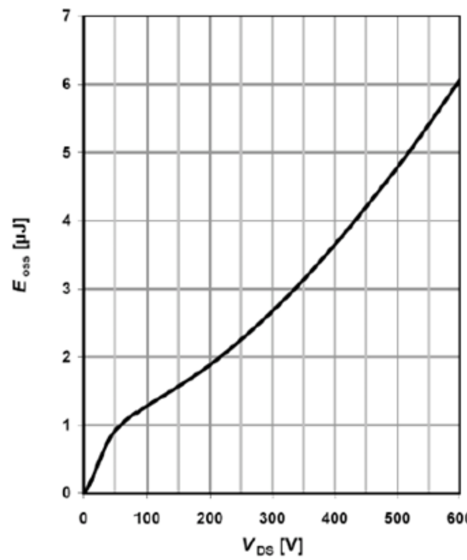
Typical Performance Characteristics

Typ. capacitances



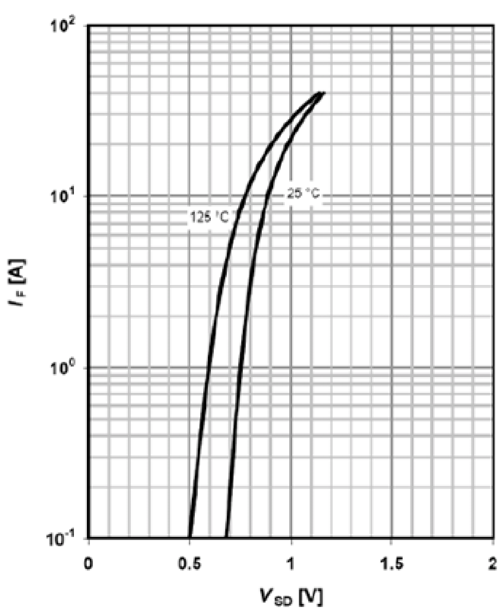
C=f(V_{DS}); V_{GS}=0 V; f=1 MHz

Typ. *Coss stored energy*



E_{OSS}=f(V_{DS})

Forward characteristics of reverse diode

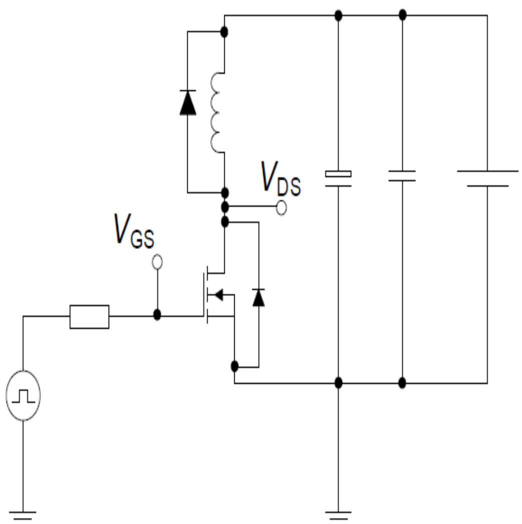


I_F=f(V_{SD}); parameter: T_j

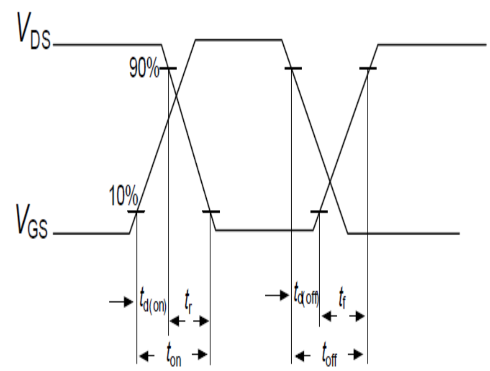
Test circuits

Switching times test circuit and waveform for inductive load

Switching times test circuit for inductive load

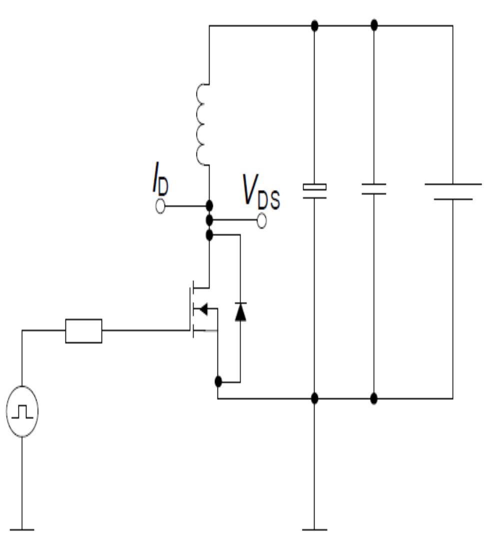


Switching time waveform

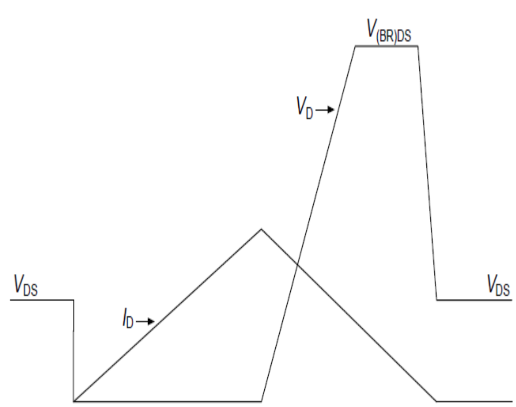


Unclamped inductive load test circuit and waveform

Unclamped inductive load test circuit



Unclamped inductive waveform



Test circuits

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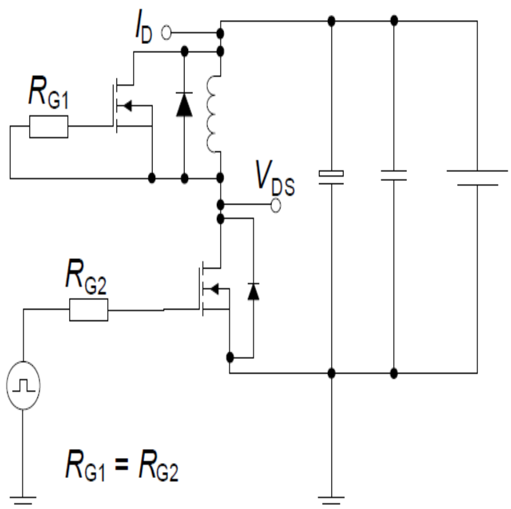
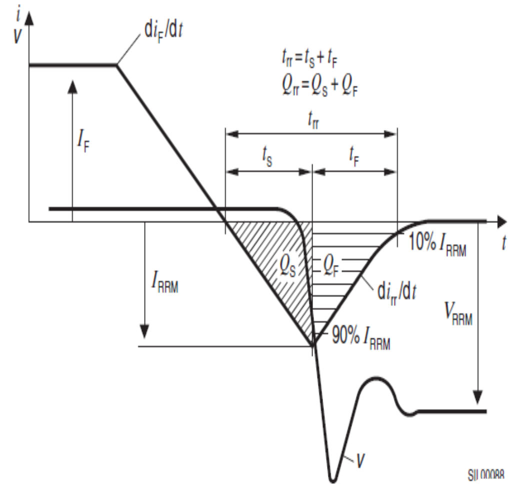
Test circuit and waveform for diode characteristics

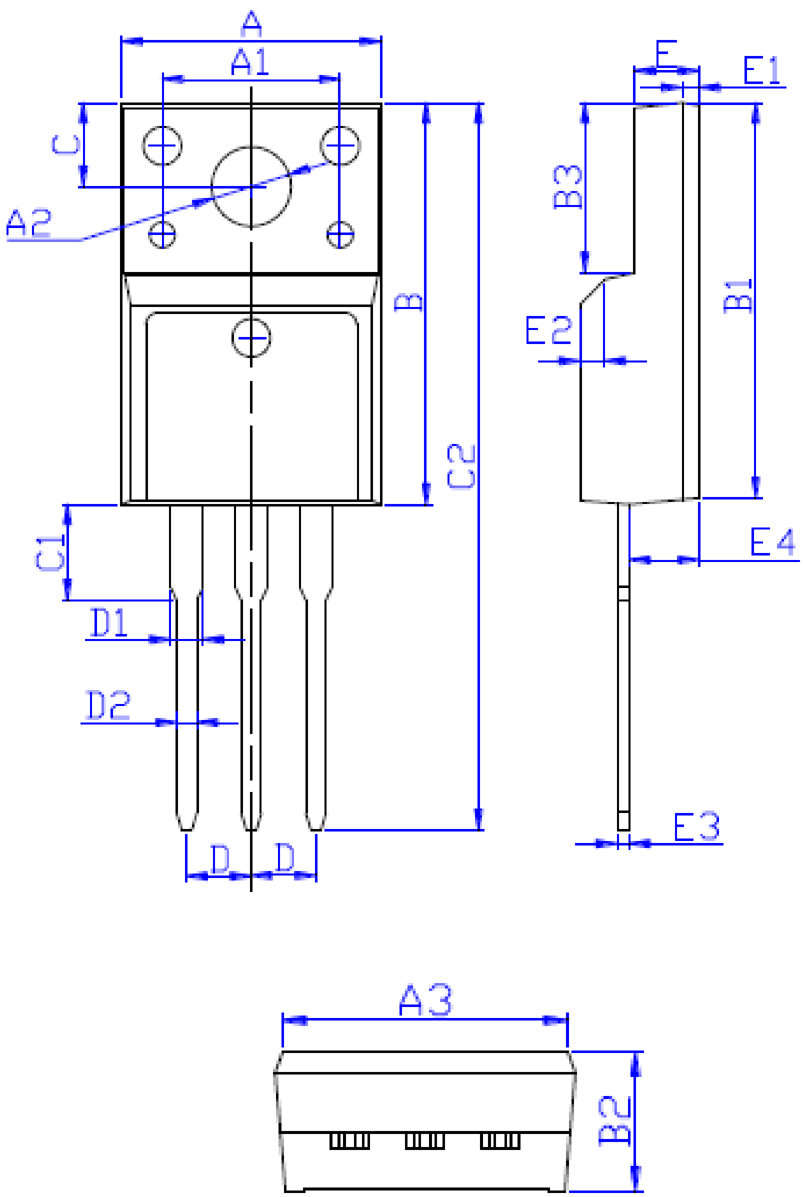
Test circuit for diode characteristics



Diode recovery waveform



Package Outline TO-220F



DIM	MILLIMETERS
A	10.16±0.30
A1	7.00±0.20
A2	3.12±0.20
A3	9.70±0.30
B	15.90±0.50
B1	15.60±0.50
B2	4.70±0.30
B3	6.70±0.30
C	3.30±0.25
C1	3.25±0.30
C2	28.70±0.50
D	Typical 2.54
D1	1.47 (MAX)
D2	0.80±0.20
E	2.55±0.25
E1	0.70±0.25
E2	1.0×45°
E3	0.50±0.20
E4	2.75±0.30